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Two hitherto confused Species of Lycopodium

BY FRANCIS E. LLOYD

[PLATE 370]

While botanizing during the past summer in southern Vermont in company with Dr. Marshall A. Howe, it was our fortune to come across, in an open sloping pasture, an extensive growth of a *Lycopodium*, which heretofore has been, in this country, referred to the variety *chamaecyparissus* of *L. complanatum*. Associated with it, and also growing in abundance was *L. complanatum*, and the very great difference in the appearance of the two plants, both as to color and habit, at once attracted our attention. Further field observation revealed the fact that the so-called variety differed from *L. complanatum* in several important details both morphological and physiological, the position of the rhizome among others. In *L. complanatum* this runs along the surface of the ground and is flattened above, develops chlorophyll in response to its exposed position, and has narrow leaves which curve upwards, while the rhizome of *L. chamaecyparissus* is strictly underground, buried to a depth of 2–4 centimeters, a fact which Dr. Howe and I sufficiently verified by digging up the new rhizomatous growths out of the tough sod at the periphery of the area covered by the colony, and which I have myself verified in many individuals subsequently found near Cold Spring, Long Island. The rhizome of this plant is, moreover, supplied with lanceolate to ovate leaves which are contracted at the base, and is white, except when, as is sometimes the case, the plant is forced out of its normal direction by hard

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obstacles, thus becoming exposed to the light. This difference of habit in respect to position was also recorded by C. F. Austin in a note in his writing attached to the sheet upon which is mounted a specimen of *L. chamaecyparissus* collected by him in Bergen county, New Jersey.

Another very pronounced and quite constant difference is the habit, on the part of *L. chamaecyparissus*, of producing annual growths at the ends of the branchlets. These new growths are more or less orthotropic, according as the habitat is exposed or shaded, and usually make angles with the earlier growth. This is especially noticeable as the aërial stems of the plant are frequently long and weak, allowing the weight of the foliage, which is often great, to force them out of their original vertical position, to make angles with the previous years' growths. There is thus produced a curious and distinctive habit which is in marked contrast with that of *L. complanatum* in which the branchlets are plagiotropic, and do not produce annual innovations except very occasionally, and then only short imperfect growths, which cannot at all be compared with the vigorous unfailing annual growth of *L. chamaecyparissus*.

Correlated with the more vertical habit of *L. chamaecyparissus* is the less pronounced dorsiventral character of the more distal branches and the similarity in form of their leaves. Here the leaves of the morphological under side of the branches are scarcely different in their amount of development from those of the upper side, while in *L. complanatum* they are so reduced that only their apices, abruptly spreading from the concave lower side of the branchlet, remain in evidence. This spreading character is common to all the leaves of *L. complanatum* while in *L. chamaecyparissus* the apices of the leaves of the lateral and under rows are appressed, so much so that those of the leaves of the lateral rows curve in underneath the flattened lower side of the branchlet.

In addition to these external leaf characters is to be added the glaucous character of *L. chamaecyparissus*, as compared with the absence of this character in *L. complanatum*. I have noticed that specimens of the former plant keep their moisture some time longer than do specimens of the latter, though I cannot give precise data on this point.

Nor are the differences wholly confined to the external and

therefore more readily observable features, for an examination of transverse sections of the branchlets shows that the parenchyma beneath the lower epidermis is made up in *L. chamaecyparissus* of elongated cells of columnar form with oblique ends, similar but a little broader than those beneath the upper epidermis. This similarity in tissue is carried also into the epidermis, the cells of which, both on the upper and lower sides are nearly of the same size and have lumina of equal proportions. In *L. complanatum*, however, the parenchyma of the lower part of the branchlet is made up of globular cells, while those above are columnar. Here, too, we find that the cells of the upper epidermis have lumina much more reduced than do those of the lower. (Pl. 370, figs. 9, 10, 11 and 12.) The sclerenchyma sheath is also more strongly developed in *L. chamaecyparissus.*

Furthermore, there is a disparity in the time at which the spores ripen, a fact also not unnoticed by Austin, who records that in Bergen county, New Jersey, the spores of *L. chamaecyparissus* ripen "from one to two months earlier than in the type" that is, *L. complanatum.* Even in Vermont, where such phenomena are compassed in a shorter time, and where these observations were made, there is a difference of at least three weeks to a month in the time of spore-ripening. This fact must be one of considerable importance.

In the light of the above facts it seems strange that these two plants have been regarded by several botanists as not deserving of separate specific rank, though it is interesting to know that the veteran Alexander Braun so regarded them and that Dillenius * fully appreciated their differences, as is evidenced by his excellent figures. It appears from descriptions and specimens that the two plants are found abundantly in Europe and have been repeatedly observed growing together. In this connection Luerssen† observes: "The two plants (*i. e.*, *L. complanatum* and var. *β chamaecyparissus*) in these extreme forms appear so different, that they might well be regarded as distinct species. They pass, gradually, however, through intermediate forms, from one to the other." This experience seems, however, not to be dupli-

* Hist. Musc. pl. 59 (*L. complanatum*) and 60 (*L. chamaecyparissus*). 1741.

† Rabenhorst, Kryptogamen-Flora. Farnpflanzen, 1: 825.

cated on this side of the Atlantic, for a careful search over an acre of ground in which a large number of colonies of both species were growing together, often intermixing, failed to discover anything at all to support this view. The two plants, growing on the same spot with their rhizomes crossing, were completely distinct. It would be of value if the botanists of this country to whom the opportunity may come, would make observations bearing on this matter. It may be added that certain European botanists appear to entertain no doubt as to the specific distinction of the two plants.

The attempt was made by the writer to find what differences, if any, existed between the spores, but without any very positive results. The spores of European specimens as well as from the United States were examined, and as much variation appears to exist between individual spores of *L. complanatum*, as between the spores of *L. clavatum* and either o these here under consideration. On the whole, however, there is a larger unreticulated area on the inside facets of the spores of *L. chamaecyparissus*, while the angles of the reticulations appear to be thickened in *L. complanatum*. I have not, however, been able to apply these criteria with unfailing certainty, so that I hesitate to assert that any value should be attached to them. There are slight differences, also, in the shape of the sporophylls, which in *L. chamaecyparissus* are usually more abruptly contracted beneath the apex than in *L. complanatum*.

LYCOPODIUM CHAMAECYPARISSUS A. Br.

Rhizomes extensively creeping 2–4 cm. below the surface of the ground, occasionally forced by obstructions to grow upward, but turning down again when the obstruction is passed, in color white, terete, sparingly branched in the horizontal plane, their whorled or loosely spirally arranged leaves lanceolate or ovate to broadly ovate (1–2 mm. broad), usually the latter, and then scarious, abruptly contracted into a narrow base, acute, their margins membranous and erose; the primary aërial shoots weak, terete, usually sinuously bent and often becoming decumbent under the weight of the superadded foliage, the axis repeatedly forking until it forms a mass of more or less vertically placed somewhat flattened branchlets which are plano-convex in transverse section, 1.5–2 mm. broad (concave beneath on drying); the terminal branchlets regu-

larly producing more or less orthotropic innovations the second and sometimes the third season, the lower and therefore older foliage branches ultimately spreading and becoming lax, some of the medially placed branches remaining short, thicker, terete, strictly vertical, and producing either additional foliage parts or ultimately running up into strobile-bearing peduncles: leaves of the primary aërial axis in 6–8 rows, those at the base of the shoot similar to those of the rhizome, appressed, passing higher up the axis from ovate through lanceolate-acute into the acuminate form; those of the subterminal and terminal branchlets in four rows, an upper, an under and two lateral, glaucous, bluish green, acuminate, appressed, those of the under row differing scarcely at all from those of the other three rows, the leaves of the lateral rows somewhat incurved underneath, all becoming shorter and more crowded towards the end of the season's growth: peduncles terete, glaucous, 50–60 mm. long to the first forking, usually twice forked, the second 8–18 mm. distant from the first, spreading and curving upward, the leaves on the peduncle and its branches spirally scattered or less commonly loosely segregated into whorls of threes, spreading-acuminate, scarious-tipped; strobiles, two, three or usually four, 20–28 mm. long, the sporophylls broadly depressed ovate, truncate at the base, the lateral margins variously toothed, suddenly contracted into a subulate scarious tip; sporangium reniform, opening by a transverse slit along the top; spores deep yellow in mass, regularly areolate on the convex face, the areolae on the triangular inner faces becoming larger, more irregular and fading away so as to leave a triangular smooth area in the internal angle, ripening early in August. (*f. 2, 3, 6, 8, 11, 12, 16, 17.*)

The aërial parts reach a maximum height of about 22 cm. exclusive of the spore-bearing parts which project an additional height of 5–7 cm. above the general level of the foliage. The color is light bluish green, and glaucous throughout except on the aged lower branches, from which the waxy layer is worn away.

Found by Dr. M. A. Howe and myself growing on a sunny slope, where the plants made very dense masses of foliage with vertically placed branchlets. Newfane, Vt., July–August, 1899. Specimens found later (Oct. 14, 1899) by myself, on the hills near Cold Spring Harbor, Long Island, N. Y., which were growing in the shade, and which were very much less vigorous than the Vermont material, have looser foliage, the branchlets of which do not stand vertically, though they do turn upward at the ends, and the

innovations grow upward. The variation in position may be regarded as a response to different light influences. This series also includes a single weak plant with widely spreading leaves, curiously mimicking a seedling of *Juniperus Virginiana*. The above material is all in the herbarium of the New York Botanical Garden.

Other herbarium material has been examined as follows:*

CONNECTICUT: New Haven, 1858, *D. C. Eaton* (GC.).

DELAWARE: near Iron Hill, Aug. 21, 1894, *A. Commons and E. Tatnall* (C.). Latrobe Canal feeder, 2 miles west of Iron Hill, Aug. 5, 1895, A. Commons (G.).

DISTRICT OF COLUMBIA, July, 1879, *L. F. Ward* (N.).

GEORGIA: Tallulah Falls, Apr. 19, 1891, *L. M. Underwood*, no. 2550a (U.).

MAINE: Mt. Desert, Sept. 5, 1891, *T. G. White* (C.). Mt. Desert Island, July 9, 1890, *John H. Redfield* (U.). Aroostook Co., St. Francis, dry woods, Aug. 9, 1895, *M. L. Fernald*, no. 217 (C. N. G. U.). Orono, "dry woods," Oct. 13, 1890, *M. L. Fernald* (G.).

MARYLAND: Bladensburg, July 20, 1879, *L. F. Ward* (U.); 1880, *L. F. Ward* (N.).

MASSACHUSETTS: Essex Co., *Oakes* (C.).

MICHIGAN: Near Alpena, July 11, 1895, *C. F. Wheeler* (G. N. C.). Sand dunes, Lake Huron, Huron Co., Aug. 5, 1896, *Charles A. Davis* (N.). Keweenaw Co., *Robbins* (G.). Keweenaw Co., "woods and fields," Aug., 1890, Sept., 1889, *O. A. Farwell*, no. 746 (G.).

MINNESOTA: Lake Kilpatrick, Caseo Co., July, 1893, *C. A. Ballard* (N.).

NEW HAMPSHIRE: "old clearings," Jaffrey, July 15, 1897, *B. L. Robinson* no. 225 (G.).

NEW JERSEY: Bergen Co., *C. F. Austin* "stems running rather deep (2–4 inches) in the ground. Of a more slender habit and generally with more numerous spikes than the typical form from which it is readily distinguished when they grow side by side by its shedding its spores 1–2 months earlier (in Aug.) and by its spikes turning saffron yellow. I have never found it except in shady places" (G.).

* The letters C, G, N, U and Y indicate the Columbia, Gray, National, Underwood and New York Botanical Garden herbaria, where the cited specimens may be consulted.

NORTH CAROLINA: mountains, Waynesville, Sept. 1896, *S. M. Huger* (C.).

PENNSYLVANIA: Tobyhanna, Pocono Mt., Aug. 20, 1887, *N. L. Britton.* (C.).

VIRGINIA: Clifton, Oct. 12, 1884, *L. F. Ward* (U.).

LYCOPODIUM COMPLANATUM L.

Rhizomes extensively creeping along the surface of the ground, exposed or in moss, etc., usually green, flattened above, furrowed on the flattened surface, sparingly branching in the horizontal plane, spirally arranged or sometimes loosely segregated in whorls: their leaves lanceolate, acuminate, scarious-tipped, the lateral ones curving upward; primary aërial shoots strong, flattened and furrowed on one side, the branches convex on the upper side, concave below (1.8–2.5 mm. broad), spreading out into a horizontal plane, the medially placed branches more nearly terete, and either producing additional foliage-bearing shoots or, ultimately, sporangium-bearing peduncles: leaves of the vertical axes spirally placed or in loose whorls, spreading, acuminate, scarious-tipped, the several (5–8) rows being reduced to four on the foliage branches; the leaves of the upper and lateral rows, which are separated as by a continuous furrow, cuspidate, with spreading apices, bright green, those of the under row reduced to slender, curved, spreading, cuspidate apices, the under side of the branchlets thus appearing devoid of foliage, lighter in color and concave; all the leaves decreasing gradually in size from the base to the tips of the branches: peduncles (5–7.5 cm. long up to the forking) terete, a little stouter than in *L. chamaecyparissus*, furrowed, forking usually twice, the first and second forks 2–5 mm. distant from each other: pedicels straight, 5–8 mm. (mostly 7–8 mm. long), bearing strobiles 15–25 mm. long: leaves of the peduncles and pedicels scattered or loosely whorled in threes, acuminate, scarious-tipped, spreading: sporophylls broadly ovate, more or less toothed on the lateral margins, contracted gradually into a scarious apex: sporangia reniform, opening by a transverse slit: spores reticulate on the four faces, ripening late in August and in September. (*f. 1, 4, 5, 7, 9, 10, 13, 14, 15.*)

CONNECTICUT: West Goshen, Aug., 1889, *L. M. Underwood* C. U.). Greens Farms, Aug. 25, 1894, *C. L. Pollard*, no. 233. An abnormal condition with asporogenous spikes (N.). Derby, July 7, 1895. "Dry woods, common," *E. H. Eames, M.D.* (N.).

DISTRICT OF COLUMBIA: Near the Sligo, north of Takoma, July 10, 1895, *C. L. Pollard*, no. 467 (N.).

INDIANA: Fern, Putnam Co., Oct., 1892, *L. M. Underwood* (U.).

MAINE: Anson, July 9, 1885, *T. F. Collins*, "Fertile" (G.).

MASSACHUSETTS: Essex Co., *William Oakes* (C.). Mt. Toby, near Amherst, July 27, 1895, *Mrs. A. F. Stevens* (N.); 1871, *Dr. Palmer* (N.). Benjamin Hill, near Winchendon, Worcester Co., Sept. 3, 1895, *C. L. Pollard* (N.). Concord, "woods around Walden Pond," Sept. 30, 1879, *W. P. Rich* (G.). Concord, Nov. 1, 1890, *L. M. Underwood* (U.). A form with six strobiles on the peduncle and more distant forkings, Northfield, July 5, 1890, *F. E. Lloyd* (Y.). Williamstown, Oct., 1891, *F. E. Lloyd* (Y.).

MARYLAND: near Signal Tree Heights, between Washington and Silver Spring roads, Oct. 7, 1893, *Adam Steitz* (N.). Spencerville, July, 1891, *J. M. Holzinger* (N.).

MINNESOTA: Soudan, St. Louis Co., 1896, *J. H. Ely* (C.). Duluth, July 26, 1889, pine woods, 16 miles west of Duluth (N.).

NEW HAMPSHIRE: southern "woods common," July 9, 1897, *B. L. Robinson*, no. 187 (G.). Seabrook, 1894, *Alvah Eaton* (with abnormal forking spikes) (U.). Benton, July 4, 1890, *S. F. Tower.*

NEW JERSEY: Clifton, Sept. 23, 1894, *T. H. Kearney, Jr.* (C.). Bergen Co., "matures its spores in September and October," *C. F. Austin* (C.). Bergen Co., "a variety with short rigid leaf-branches and numerous short spikes," *C. F. Austin* (C.). Stockholm, "swamp, 1100 ft. alt.," Aug. 1–15, 1895, *Wm. M. Van Sickle* (N.).

NEW YORK: Tannersville, Greene Co., Oct. 6, 1891, *A. M. Vail* (C.). "Dry copse, near woodland, common," Nov. 28, 1890, *R. Kenyon* (N.). Cold Spring Station, Long Island, in deep woods, Oct. 14, 1899, no spikes found, *F. E. Lloyd* (Y.). Morrisville, Oct., 1878, *L. M. Underwood* (U.). West Camden, 1897, *Arma A. Smith* (U.).

ONTARIO: Gun Flint Lake, July 18, 1891, *F. F. Wood* (N.).

PRINCE EDWARD ISLAND: Cantire, Sept. 3, 1883, *John Macoun* (C.).

QUEBEC: Notre Dame du Lac, Termiscouata Co., Aug. 2, 1887, *John I. Northrop* (C.).

VERMONT: Willoughby Lake, Aug. 22, 1895, *Mrs. G. F. Stevens* (N.); Willoughby, July 26, 1892, *H. H. Rusby* (C.); Newfane, July–Aug., 1899, *M. A. Howe and F. E. Lloyd* (Y.).

WEST VIRGINIA: South Fork of Holston River, Smyth Co., June 15, 1892, *N. L. and E. G. Britton and A. M. Vail* (C.).

Explanation of Plate 370

The figures were drawn from specimens collected near Newfane, Vt., growing in the same habitat. Figures 3–8 were drawn to the same scale × 9, as were also figures 9–12 and 13–17.

FIG. 1. *Lycopodium complanatum;* upper part of aërial shoot bearing two peduncles, only one of which is shown. × ⅔.

FIG. 2. *Lycopodium chamaecyparissus;* upper part of aërial shoot. In this particular plant the peduncle does not extend as far as it does normally above the general level of the foliage. The terminal branchlets can be seen to make definite angles with the subterminal, previous year's growth. × ⅔.

FIGS. 3, 6, 8. Upper, under and lateral views respectively, of a part of a branchlet of *Lycopodium chamaecyparissus.*

FIGS. 4, 5 and 7. Upper, under and lateral views respectively, of a part of a branchlet of *Lycopodium complanatum.*

FIGS. 9 and 10. Portions of the epidermis and subjacent parenchyma from the upper and under sides respectively, of a branchlet of *Lycopodium complanatum.*

FIGS. 11 and 12. The same of *Lycopodium chamaecyparissus.*

FIGS. 13 and 14. Outlines of scales from the rhizome of *Lycopodium complanatum.*

FIG. 15. Sporophyll of *Lycopodium complanatum.*

FIG. 16. Sporophyll of *Lycopodium chamaecyparissus.*

FIG. 17. Half-outlines of scales from the rhizome of *Lycopodium chamaecyparissus.*

The dichotomous Panicums; Some new Species.—I

By Geo. V. Nash

Panicum Bushii

A tufted perennial, glabrous, with the exceptions noted below. Culms about 3 dm. tall, the nodes sparingly barbed, finally much branched: leaves about 3; sheaths about as long as the internodes, those on the branches short and overlapping; ligule a dense ring of short hairs about 0.2 mm. long; blades erect, linear, acuminate, serrulate and very rough on the margins, ciliate at the base with a few very long hairs arising from papillae, the larger primary blades 8–10 cm. long, 3–4 mm. wide, those on the branches usually 6 cm. or less long: panicle much exserted, 6–7 cm. long, its branches erect-ascending, the larger 3–3.5 cm. long, the secondary panicles much smaller: spikelets 2.5 mm. long and about 1.2 mm. broad, obovate, the scales glabrous, the first scale orbicular or very broadly ovate, 1-nerved, rounded or obtuse at the apex, about one-third as long as the spikelet, the second and third scales 7-nerved, the second a little the shorter, the fourth scale yellowish white, about 2 mm. long and 1.2 mm. wide, about as long as the second.

Collected by B. F. Bush, in dry ground, in McDonald Co., Missouri, July 24, 1893 no. 413. Related to *P. augustifolium*, but the spikelets are glabrous and of a different shape and the sheaths and blades glabrous.

Panicum ciliosum

A tufted perennial. Culms 3–5 dm. tall, rather stout, ascending, papillose-hirsute with spreading hairs, finally much branched: leaves 4 or 5; sheaths shorter than the internodes, densely hirsute with spreading hairs, ciliate on the margins; ligule a dense ring of hairs about 0.5 mm. long; blades erect or ascending, narrowed toward the base, glabrous above, ciliate on the margins, the stiff hairs arising from papillae, the lower surface densely pubescent between the nerves with short spreading hairs: panicle broadly ovate, about 8 cm. long, included at the base, its axis pubescent with short hairs, the branches spreading, the larger about 3 cm. long: spikelets a trifle less than 2 mm. long and about 0.9 mm. wide, elliptic, the outer 3 scales strongly pubescent with rather long spreading hairs, the first scale broader than long, about one quarter as long as the spikelet, 1-nerved, rounded at the apex, the

second and third scales 7-nerved, about equal in length, the fourth scale white, a little longer than the third, about 1.6 mm. long and 0.8 mm. wide.

Type collected by S. M. Tracy, at Biloxi, Mississippi, September 1, 1898, no. 4580. In habit and general appearance much resembling *P. pubescens*, but the ciliate blades with the upper surface glabrous at once separate it. The specimen above described is the late state and has the panicle included; the early form of the plant will probably be found to have an exserted primary panicle.

Panicum Clutei

A tufted perennial, glabrous, with the exceptions noted below. Culms rather stout, 6–8 dm. tall, at length branched: leaves 4 or 5; sheaths rather loose, minutely pubescent at the apex and usually more or less ciliate on the exterior margin, the exterior basal ones pubescent; ligule a dense ring of hairs about 0.3 mm. long; blades firm, ascending, often appearing as if erect in pressing, lanceolate, smooth on both surfaces, rough on the margins, the lower and larger 7–14 cm. long, 7–12 mm. wide, the basal blades ovate-lanceolate, 3–4 cm. long and 10–13 mm. wide, long-ciliate on the margins: panicle considerably exserted, broadly ovate, 6–10 cm. long, its ascending branches smooth, the larger ones 4–6 cm. long: spikelets oval, acutish, about 2.3 mm. long and about 1.3 mm. wide, the first scale broadly ovate, obtuse or somewhat acute, 1-nerved, glabrous or nearly so, the second and third scales densely pubescent with very short ascending hairs, 9-nerved, the second one shorter than the third and usually a little shorter than the fourth, the fourth scale yellowish, oval, about 2 mm. long and about 1.2 mm. wide.

Pine-barrens of southern New Jersey. Collected by Mr. W. N. Clute, after whom I take pleasure in naming it, on a trip from Tuckerton to Atsion, July 3–6, 1899. A most distinct species.

Panicum curtifolium

A tufted perennial, glabrous, with the exceptions noted below. Culms slender, weak, 2–3 dm. tall, finally much branched: leaves 3 or 4; sheaths less than one half as long as the internodes, usually about one third as long, sparsely pubescent with long weak spreading hairs; ligule a dense ring of hairs about 0.3 mm. long; blades widely spreading, lanceolate, minutely serrulate and rough on the margins, a few long hairs on the upper surface just back of the ligule, the culm blades 1.5–3 cm. long, 3–4.5 mm. wide, the basal leaves 4–5 cm. long: panicle considerably exserted, broadly ovate,

2.5–3.5 cm. long, its slightly hispid branches widely spreading, the larger 1.5–2 cm. long: spikelets about 1.5 mm. long and about 0.75 mm. wide, elliptic, the scales glabrous, the first scale about one third as long as the spikelet, broadly ovate, obtuse, 1-nerved, the second and third scales 7-nerved, the second shorter than the third, the fourth scale about equalling the third, about 1.25 mm. long and about 0.6 mm. broad, yellowish-white, obscurely apiculate.

Collected by S. M. Tracy at Ocean Springs, Mississippi, May 2, 1898, no. 4598. Related to *P. lucidum* Ashe, but distinguished by its smaller spikelets and sparsely pubescent sheaths.

Panicum decoloratum

A more or less purplish tufted perennial, glabrous, with the exceptions noted below. Culms 4–6 dm. tall, stout, finally branched, the nodes barbed: leaves 5 or 6, extending to the base of the panicle, the upper one including its base; sheaths loosely embracing the culm, usually overlapping and hence concealing the culm, the lower and basal ones papillose-hirsute between the nerves, the hairs of the former early deciduous, the upper sheaths ciliate on the external margin and with a minutely pubescent ring at the apex; blades erect or ascending, variously colored with black-purple, broadly lanceolate, a little rough on both surfaces, especially above, cordate-clasping at the base, 7–12 cm. long, 1.2–2 cm. wide, minutely serrulate and very rough on the margins: panicle included at the base, its branches hispidulous: spikelets on hispidulous pedicels, 2.7 mm. long and 1.3 mm. wide, elliptic, the first scale from nearly orbicular to broadly ovate, about one third as long as the spikelet, 1-nerved, obtuse or rounded at the apex, glabrous, the second and third scales rather sparingly pubescent with ascending hairs, 9-nerved, the second scale a little shorter than the third, the fourth scale slightly yellowish-white, about 2.4 mm. long and 1 mm. wide, obtusely and rather obscurely apiculate, minutely pubescent at the apex.

Collected by Mr. E. P. Bicknell on a sandy railroad bank at Tullytown, Pennsylvania, May 30, 1899. The panicle in the material at hand may not be fully developed, and so a later stage may show it exserted instead of included at the base. In habit much resembling *P. clandestinum*, but that species is larger in every way, the pubescence is harsh and hispid and occurs on all the sheaths, the blades are much longer and with the margins near the base conspicuously ciliate with long stiff hairs, and the spikelets are larger (exceeding 3 mm. in length).

Panicum Earlei

A densely tufted perennial. Culms slender, 1–1.5 dm. tall, usually with a few long weak scattered hairs below, finally branched, the nodes rather sparingly barbed: leaves about 3; sheaths rather sparingly hirsute with long hairs; ligule a dense ring of hairs about 0.3 mm. long; blades ascending, lanceolate, rather sparingly hirsute on both surfaces with long spreading hairs, 1–3 cm. long, 2–6 mm. wide, minutely serrulate and roughened on the margins: panicle broadly ovate, 2–3 cm. long, its smooth branches spreading, the larger ones 1–1.5 cm. long: spikelets about 1.3 mm. long and 0.7 mm. wide, elliptic, obtuse, glabrous, the first scale orbicular or broadly oval, 1-nerved, obtuse, the second and third scales 7-nerved, the second scale shorter than the third and fourth, the fourth scale white, about 1 mm. long and 0.6 mm. wide, oval.

Type collected at Auburn, Lee Co., Alabama, on May 7, 1898, by Messrs. F. S. Earle and C. F. Baker, no. 1532; no. 1535, of the same place and date, also belongs here.

Panicum epilifolium

A tufted perennial, glabrous, with the exceptions noted below. Culms 2–3.5 dm. tal : leaves 2 or 3; sheaths shorter than the internodes, minutely pubescent at the apex, ciliate on both margins with long slender hairs; ligule a scarious ciliolate ring about 0.2 mm. wide; blades widely spreading, linear-lanceolate, 4–7 cm. long, 5–7 mm. wide, minutely pubescent on the upper surface between the nerves, serrulate and very rough on the margins: panicle exserted, ovate, 5–7 cm. long, its branches spreading or ascending, the larger ones 2–2.5 cm. long: spikelets 3 mm. long and about 1.5 mm. broad, oval, obtusely apiculate, the first scael glabrous or with a few scattered hairs, 1-nerved, nearly orbicular, acute, a little less than one half as long as the spikelet, the second and third scales densely pubescent with short spreading hairs, 9-nerved, the second usually a little shorter than the third and fourth, the latter scale yellowish, 2.5 mm. long and a little over 1 mm. wide, elliptic, obtusely apiculate.

Type collected by the writer in a scrub hammock at Eustis, Lake Co., Florida, March 12–31, 1894, no. 45. Also secured at the same place by Professor L. M. Underwood, on March 22, 1891, no. 2250. It bears some resemblance in habit to *P. ciliiferum*, but is readily distinguished from that species by its glabrous sheaths, naked blade-margins and more acute spikelets.

Panicum flavovirens

A densely tufted light green perennial, glabrous, with the exceptions noted below. Culms 2–3 dm. tall, slender, finally much branched: leaves 2 or 3; sheaths very short, those of the primary leaves about one third as long as the internodes, one margin usually extending above the other, making the summit of the sheath more or less oblique, the lower sheaths ciliate on the margin, the exterior basal ones pubescent all over; ligule a dense ring of short hairs about 0.2 mm. long; blades thin, erect, without a white margin or nearly so, entire or very minutely serrulate, hence smooth or nearly so on the margin, linear-lanceolate, those on the main culm 2.5–4 cm. long, 2.5–4 mm. wide, commonly minutely pubescent on the lower surface between the nerves, those on the branches much shorter, the basal blades longer, 4–6 cm. long: panicle much exserted, 3–4 cm. long, broadly ovate, its branches spreading, the larger 1–2 cm. long, the secondary panicles much smaller, barely exserted and with spreading branches: spikelets 1.5 mm. long and 0.7 mm. broad, elliptic, the outer 3 scales densely pubescent with spreading hairs, the first scale 1-nerved, broadly ovate, obtuse, about one half as long as the spikelet, the second and third scales 7-nerved, about equal in length, the fourth scale yellowish-white, 1.3 mm. long and about 0.6 mm. wide.

Type collected by the writer in Lake Co., Florida, June 16–30, 1895, no. 2061; growing in swampy woods along the edge of road leading to the ford near the J. T. & K. W. R. R. bridge across the Wekiva river. No. 2487a, collected in a similar habitat at Lake City, Columbia Co., in the same state, on Aug. 30, 1895, is also referred here.

Differs from *P. albomarginatum* in the thin linear-lanceolate blades which are entirely or almost devoid of the white margin, and barely if at all rough on the margins. In *P. albomarginatum* the blades are very thick, much broader, and with a wide strongly serrulate white margin which is much thickened.

Panicum Helleri

A tufted perennial, glabrous, with the exceptions noted below. Culms 2–4 dm. tall, appressed-pubescent below with long hairs, the nodes sparingly barbed, finally branched: leaves 5; sheaths shorter than the internodes, the middle ones only about one half as long, ciliate on the exterior margin, bearing between the prominent nerves scattered papillae, from which sometimes arise stiff

hairs, the internerves of all but the upper sheaths minutely pubescent: ligule a dense ring of hairs about 0.6 mm. long: blades broadly lanceolate, thin, a little narrowed toward the sparsely ciliate rounded base, the margins minutely serrulate, rough, 6–8 cm. long, 6–12 mm. wide: panicle included at the base, 6–8 cm. long, its branches ascending, the larger ones 3–4 cm. long, the secondary panicles smaller: spikelets 3.25–3.5 mm. long and about 1.5 mm. wide, the first scale broadly triangular-ovate, 1-nerved, the second and third scales pubescent toward the base with a few scattered hairs, the second scale 11-nerved, the third scale 9-nerved, the fourth scale yellowish-white, 2.5 mm. long and about 1.3 mm. wide, oval, obtusely and obscurely apiculate.

Collected at Kerrville, Kerr Co., Texas, by A. A. Heller, May 14–21, 1894, no. 1759. Differs from *P. pernervosum* in the pubescent culm and sheaths, the broader blades of a different shape and the narrow spikelets which are usually sparsely pubescent.

Panicum paucipilum

A tufted perennial, glabrous, with the exceptions noted below. Culms 6–10 dm. tall, finally sparingly branched: leaves 5–8; sheathes one third to one half as long as the internodes, the external margin ciliate toward the summit; ligule a dense ring of hairs about 2 mm. long: blades erect or ascending, thickish, rather firm, sometimes minutely puberulent on the lower surface, usually with a few hair-bearing papillae at the base, the lower and larger 6–9 cm. long, 5–7 mm. wide: panicle finally considerably exserted, rather dense, oblong, usually 5–10 cm. long, its branches erect-ascending or erect, the larger ones 2.5–4 cm. long: spikelets numerous, about 1.4 mm. long and 0.8 mm. wide, oval, the first scale about one third as long as the spikelet, 1-nerved, orbicular, the second and third scales pubescent with spreading hairs, the former plainly, the latter obscurely, 9-nerved, the fourth scale yellowish, about 1.3 mm. long and 0.8 mm. wide, obscurely apiculate.

In wet soil, southern New Jersey to Mississippi. Type collected by Mr. E. P. Bicknell, at Wildwood, New Jersey, May 30 and 31, 1897. The following specimens from Mississippi are also referred here:

Ocean Springs, July 19, 1889, F. S. Earle; Biloxi, Sept. 1, 1892, S. M. Tracy; Beauvoir, May 13, 1898, S. M. Tracy, no. 4594 (distributed as *P. octonodum* S. & S.).

Intermediate between *P. octonodum* and *P. Eatoni*. Differs from the former, to which it is closely related, in the ciliate margin

of the sheaths, the few basal hairs of the blades, and particularly in the strongly pubescent spikelets. From *P. Eatoni* it may be distinguished by its much smaller spikelets with the first scale glabrous and orbicular.

Panicum longiligulatum

A tufted perennial, glabrous, with the exceptions noted below. Culms 4–5 dm. tall, slender, finally branching, the branches fasciculately much divided and forming dense masses at their ends; leaves 4 or 5; sheaths usually from one third to one half as long as the internodes, minutely pubescent between the prominent nerves; ligule a ring of long erect silky hairs about 3 mm. in length; blades ascending, lanceolate, obtusely and minutely pubescent on the lower surface, the margins serrulate and very rough, the primary culm blades 2.5–3 cm. long, about 3 mm. wide, those on the branches much smaller, the basal blades thick, broadly lanceolate, 4–5 cm. long: panicle oval, 5–6 cm. long, considerably exserted, its branches spreading, the larger ones about 3 cm. long: spikelets about 1.3 mm. long and 0.8 mm. wide, oval, the outer 3 scales densely pubescent with spreading hairs, the first scale ovate, 1-nerved, about one third as long as the spikelet, the second and third scales 7-nerved, about equal in length, the fourth scale yellowish white, about 1.2 mm. long and 0.7 mm. wide.

Collected by Dr. Geo. Vasey, at Apalachicola, Florida, in 1892. Its relationship is with *P. parvispiculum*, but its more slender culms, smaller blades and spikelets and the glabrous margins of the sheaths at once distinguish it.

Panicum patentifolium

A tufted purplish perennial, glabrous, with the exceptions noted below. Culms erect or nearly so, 2–4 dm. tall, puberulent, slender, finally much branched: leaves 2–4, rather distant; sheaths less than one half as long as the internodes, minutely pubescent, especially at the apex on the margins, rather loosely embracing the culm; ligule a dense ring of hairs about 0.25 mm. long; blades widely spreading, firm, lanceolate, 2.5–4 cm. long, 2–4 mm. wide, puberulent at the very base on the upper surface, smooth on both sides, rough on the margins, the basal ones similar in shape and texture but larger: panicle at length considerably exserted, broadly ovate, 4–6 cm. long, its axis and spreading branches puberulent, the larger branches 2–3 cm. long: spikelets about 2.5 mm. long and 1.3 mm. wide, the first scale orbicular, clasping, purple, at least at the base, 1-nerved, rounded at the apex, one half as long

as the spikelet, the second and third scales pubescent with spreading hairs, 7-nerved, the fourth scale white, a little exceeding 2 mm. in length, oval, minutely pubescent at the apex.

Type collected by the writer at Eustis, Lake Co., Florida, March 12–31, 1894, no. 72, in dry sand in a scrub hammock. No. 52 of the same collection also belongs here.

Related to *P. Webberianum*, but the more slender culms and the smaller and widely spreading blades readily separate it.

Panicum perlongum

A tufted pubescent perennial. Culms 2–4 dm. tall, simple, glabrous or sparingly pubescent, the nodes barbed, later with short basal culms: leaves 1 or 2; sheaths hirsute with long ascending hairs; ligule a dense ring of hairs about 0.7 mm. long; blades elongated, linear, erect, papillose-hispid beneath, glabrous, rough above, 2–3 mm. wide, the upper blade commonly 8–14 cm. long, occasionally shorter: panicle much exserted, generally extending beyond the apex of the upper leaf, 4–6 cm. long, its branches erect or erect-ascending, the larger ones usually 2–3 cm. long: spikelets, on hispidulous pedicels, obovate, about 3.25 mm. long and 1.5–1.75 mm. wide, the outer 3 scales with a few scattered long hairs, especially near the base, the first scale one quarter to one third as long as the spikelet, orbicular-ovate, 1-nerved, the second and third scales 9-nerved, about equal in length, the fourth scale oval, 2.5 mm. long and about 1.5 mm. wide, yellowish white, obtusely apiculate, its summit reaching the apex of the third scale.

On prairies and dry soil, Illinois to North Dakota, south to Indian Territory. Type collected in Indian Territory at Creek Nation, by M. A. Carlton, April 25, 1891, no. 98, and distributed as *P. depauperatum* Muhl. It differs from that species in the smaller pubescent obtuse spikelets with the second and third scales not exceeding the fourth scale. From *P. linearifolium*, to which it is more nearly related, it is separated by its larger sparsely pubescent spikelets.

The following specimens, distributed as *P. depauperatum* Muhl., are also referred here:

ILLINOIS: June 7, 1848, *S. B. Mead.*

SOUTH DAKOTA: Custer, July 18, 1892, *P. A. Rydberg*, no. *1100.*

IOWA: Ames, June 22, 1896, *C. R. Ball*, no. *145.*

KANSAS: Prairie, Riley Co., 1896, *A. S. Hitchcock*, no. *881.*

Panicum pernervosum

A glabrous perennial. Culms 3–5 dm. tall, finally branching: leaves 3 or 4; sheaths ciliate on the exterior margin, the lower longer, the upper shorter than the internodes; ligule a dense ring of hairs about 0.5 mm. long; blades erect or ascending, narrowed toward the base, serrulate and very rough on the margins, the intermediate and upper blades 5–10 cm. long, 5–9 mm. wide, ciliate toward the base with a few long hairs, the lower ones usually pubescent on the lower surface, shorter and broader, ciliate for two thirds their length: panicle considerably exserted, 7–12 cm. long, its branches ascending, the larger ones 4–6 cm. long: spikelets 3 mm. long and 1.8 mm. wide, broadly oval, turgid, rounded at the apex, the scales glabrous, the first scale broader than long, 1-nerved, about one third as long as the spikelet, the second and third scales coarsely 9-nerved, the second a little shorter than the third, the fourth scale yellowish white, 2.5 mm. long and about 1.6 mm. broad, obtusely and rather obscurely apiculate.

Type collected by Elihu Hall in woods, at Houston, Texas, April 16, 1872, no. 830. Mr. G. C. Nealley also secured it in the same state in 1886.

Panicum psammophilum

A tufted perennial. Culms 2–4 dm. tall, appressed-hirsute below, puberulent above, finally much branched: leaves on the main culm about 4, occasionally 3 or 5; sheaths shorter than the internodes, appressed-pubescent, the basal ones with long hairs, the upper and those on the branches with very short hairs; ligule a dense ring of hairs about 1 mm. long; blades erect or nearly so, thick, firm, serrulate on the margins, puberulent beneath, the ovate-lanceolate basal ones, and occasionally also those on the culm, with a few very long scattered erect hairs on the upper surface, the primary blades lanceolate, 2–5 cm. long, 2–5 mm. wide, those on the branches 2–3 cm. long, 2–3 mm. wide; primary panicle broadly ovate, usually 2–3 cm. long, rarely larger, its axis and usually ascending branches puberulent: spikelets broadly obovate, 1.3–1.5 mm. long, rarely a little larger, and 0.8–1 mm. wide, obtuse, the outer 3 scales densely pubescent with spreading hairs, the first scale usually about one third as long as the spikelet, sometimes a little larger, 1-nerved, orbicular or broadly ovate, acute or obtuse, the second and third scales 9-nerved, the second usually a little shorter than the third, the fourth scale yellowish, 1.2–1.5 mm. long, oval.

In sandy soil, on or near the coast, Massachusetts to New Jersey. Specimens examined:

MASSACHUSETTS: Martha's Vineyard, *Miss Witman*, July, 1890; Ipswich, *Geo. V. Nash*, Aug. 25, 1898, no. *32*.

NEW YORK: Fisher's Island, *C. B. Graves*, Aug. 29, 1898, no. *12*.

NEW JERSEY: Wildwood, May 30 and 31, 1897, *E. P. Bicknell*; Tom's River, July 25–31, 1898, *W. N. Clute*, no. 175 (type); Tuckerton to Atsion, July 3–6, 1899, *W. N. Clute*.

Related to *P. Addisonii*, but at once distinguished by its smaller and relatively broader spikelets.

Panicum pseudopubescens

A densely tufted pubescent perennial. Culms usually rather stout at the base, 2–4 dm. tall, hirsute with ascending hairs, finally branched, the nodes barbed: leaves usually 3; sheaths less than one half as long as the internodes, densely hirsute with spreading hairs 1.5–2 mm. long; ligule a dense ring of hairs about 0.5 mm. long; blades erect, rather firm, lanceolate, serrulate and very rough on the margins, 4–10 cm. long, 3–11 mm. wide, densely hispid on the lower surface with spreading hairs, the upper surface with a ring of long stout erect hairs just back of the ligule and usually also more or less hirsute with spreading hairs: panicle considerably exserted, broadly ovate, 5–9 cm. long, its axis glabrous or with a few scattered hairs below, the branches with the axils sparingly hirsute, ascending or spreading, the larger ones 2.5–5 cm. long: spikelets 2.25–2.5 mm. long and 1–1.2 mm. wide, obovate, a little pointed, the first scale usually about one third as long as the spikelet, 1-nerved, glabrous or sparingly pubescent, broadly ovate or nearly orbicular, acute or obtuse, the second and third scales densely pubescent with spreading hairs about 0.25 mm. long, commonly 9-nerved, the second a little shorter than the third, the fourth scale nearly white, a little less than 2 mm. long and about 1 mm. wide, oval.

Type collected at Auburn, Lee Co., Alabama, May 7, 1898, by Messrs. F. S. Earle and C. F. Baker, no. 1537. Nos. 1522, 1524, 1526 and 1529, of this same collection, are also referred here. It is distinguished from any form of *P. pubescens* by its much larger spikelets, and from *P. Atlanticum* by the shorter pubescence and stouter culms

Panicum pubifolium

P. latifolium var. *molle* Vasey, Contr. U. S. Nat. Herb. **3**: 33. 1892. Not *P. molle* Sw. 1788.

P. Porterianum Nash, Bull. Torr. Bot. Club, **22**: 420. In part. 1895.

A softly pubescent densely tufted perennial. Culms 3–7 dm. tall, pubescent with soft weak spreading hairs, those at the base the longer, finally branched, the nodes densely barbed with long hairs: leaves 3–5; sheaths shorter than the internodes, often only one half as long, ciliate on the margins, densely pubescent, at least all but the uppermost, with spreading weak usually long hairs, also a dense ring of short hairs at the apex; blades spreading or ascending, minutely serrulate and very rough on the margins, ovate-lanceolate to ovate, acuminate, gradually narrowed to the rounded cordate-clasping base, often inequilateral, pubescent on both surfaces with short soft spreading hairs, the upper primary blades 7–11 cm. long and 2–3 cm. broad, the lower primary blades, as well as those on the branches, smaller: primary panicle usually but little exserted, sometimes included at the base, 7–11 cm. long, its axis, as well as the branches, densely pubescent with short soft spreading hairs, the branches spreading or ascending, the larger ones 3–4 cm. long, the secondary panicles much smaller, included at the base: spikelets 4–5 mm. long and about 1.6 mm. broad, narrowly obovate, the scales distantly inserted on the rachilla, the outer 3 scales strongly pubescent with long spreading hairs, the first scale 3-nerved, from two fifths to one half as long as the spikelet, obtuse or acute, the second scale 11-nerved, the third scale 9-nerved, the former a little shorter than the latter, the fourth scale yellowish, 3.5 mm. long and 1.4–1.6 mm. broad, pubescent at the obtusely apiculate apex.

Usually in rocky woods, New York to Missouri, south to Florida and Mississippi.

Among a large number of specimens of this grass examined, the following are referred to as well representing this species:

PENNSYLVANIA: Chestnut Hill, Easton, July 1, 1887, *T. C. Porter* (distributed as *P. Walteri molle*).

DISTRICT OF COLUMBIA: Washington, June 9, 1894, *Th. Holm*, no. 14 (distributed as *P. latifolium*).

VIRGINIA: Between Fall Creek and Danville, June 3, 1891, *J. K. Small* and *A. A. Heller*, no. 466 (distributed as *P. latifolium*).

MISSOURI: McDonald Co., July 24, 1893, *B. F. Bush*, no. 415 (distributed as *P. latifolium*); Montier, June 30, 1894, *B. F. Bush*, no. 754 (distributed as *P. Walteri*).

TENNESSEE: Knox Co., July 9, 1893, *T. H. Kearney, Jr.* (dis-

tributed as *P. Walteri molle*); Knoxville, July, 1898, *A. Ruth*, no. 78 (distributed as *P. Porterianum*).

GEORGIA: Stone Mt., Aug. 1–6, 1895, *J. K. Small* (distributed as *P. Porterianum*).

Readily distinguished from *P. Porterianum* by the pubescent sheaths and the lower surface of the blades and the hirsute panicle.

Panicum pyriforme

A densely tufted perennial. Culms 3–4 dm. tall, rather slender, glabrous, rather weak, finally much branched; leaves usually 2, or sometimes 3; sheaths much shorter than the internodes, densely papillose-hirsute with reflexed hairs; ligule a ring of hairs about 0.3 mm. long; blades thin, lax, glabrous on both surfaces, serrulate and very rough on the glabrous margins, long-acuminate, narrowed to the barely rounded base, 1–2 dm. long, 8–12 mm. wide, the basal ones often 2.5 dm. in length, the blades on the branches much shorter: panicle much exserted, ample, loose and open, 6–11 cm. long, its branches widely spreading, the larger ones 4–6 cm. long: spikelets rather few, about 2.5 mm. long and 1.5 mm. wide, broadly obovate, the first scale about one third as long as the spikelet, broadly triangular-ovate, 1-nerved, the second and third scales densely pubescent with long hairs, 9-nerved, the fourth scale yellowish white, about 2 mm. long and 1.5 mm. wide, oval, strongly apiculate.

Type collected by the writer in clay soil, at Orange Bend, Lake Co., Florida, March 12 31, 1894, no. 239. The larger spikelets and glabrous blades at once distinguish this from *P. laxiflorum*, to which it is otherwise related. The following numbers of my collection of 1895 are also referred here: 2034, 2156, 2531a.

Panicum strictifolium

A tufted perennial. Culms 2.5–5 dm. tall, strongly pubescent toward the base with long stiff hairs, puberulent toward the summit, finally much branched: leaves 3 or 4; sheaths much shorter than the internodes, the lower ones densely pubescent with long stiff appressed hairs, the upper ones more sparingly so; ligule a dense ring of hairs about 1 mm. long; blades erect or nearly so, rather firm, narrowly lanceolate, appressed-pubescent beneath with stiff hairs, the upper surface often with a few scattered long hairs, the lower blades also with a ring of very long stiff hairs just back of the ligule, serrulate and rough on the margins, the primary blades 4–7 cm. long, 3–5 mm. wide: panicle broadly ovate, 5–7 cm. long, its axis and spreading branches minutely pubescent, the lower

branches 2.5–3.5 cm. long: spikelets obovate, 3 mm. long and about 1.5 mm. wide, the first scale a little more than one half as long as the spikelet, broadly ovate, clasping at the base, 3-nerved, sparingly pubescent, the second and third scales densely pubescent with rather long spreading hairs, 11-nerved, the second distinctly shorter than the third and the fourth, the fourth scale yellowish-white, oval, 2.5 mm. long and about 1.3 mm. wide.

Collected by the writer in the high pine land at Eustis, Lake Co., Florida, May 3, 1894, no. 603. Most nearly related to *P. malacon*, but distinguished by the less copious pubescence which is much finer and softer, and by the glabrous upper surface of the blades. From *P. ciliiferum* it is at once separated by its narrower blades which are not ciliate on the margins.

Panicum trifolium

A much tufted perennial, glabrous, with the exceptions noted below. Culms slender, 2–4 dm. tall, finally a little branched: leaves usually 3, rarely 4, the uppermost one much above the middle of the culm and generally but a little below the panicle; sheaths less than one half as long as the internodes, sometimes but one quarter as long: ligule a dense ring of hairs about 0.4 mm. long; blades erect or nearly so, firm, lanceolate, often minutely pubescent on the lower surface, the margins thickened and cartilaginous, serrulate and very rough, 1.5–6 cm. long, 1.5–5 mm. wide, the basal ones numerous, 4–6 cm. long: panicle more or less exserted, broadly ovate, 2.5–6 cm. long, its branches ascending, the larger ones 1.5–3 cm. long: spikelets 1.5 mm. long and about 0.7 mm. wide, elliptic, the first scale nearly orbicular, glabrous, 1-nerved, one quarter to one third as long as the spikelet, the second and third scales densely pubescent with short spreading hairs, 7-nerved, the fourth scale white, 1.3 mm. long and about 0.6 mm. wide, obtusely and obscurely apiculate.

In sandy soil, North Carolina to northern Florida, west to Mississippi. Type collected by Dr. John K. Small, in the Ocmulgee River Swamp, below Macon, Georgia, May 18–24, 1895. The following specimens are also referred here:

NORTH CAROLINA: Chapel Hill, *W. W. Ashe* (distributed as *P. ensifolium*).

SOUTH CAROLINA: Aiken, 1867, *H. W. Ravenel.*

FLORIDA: Chapman, 1890, no. 3; Apalachicola, 1892, *Dr. Geo. Vasey.*

ALABAMA: Buckley; Auburn, May 5, 1898, *Earle and Baker*, nos. 1534 and 1547a.

MISSISSIPPI: *S. M. Tracy*, Biloxi, Aug. 1, 1894, no. 2865, March 28, 1898, no. 4602, April 2, 1898, no. 4612; Avondale, April 28, 1898, no. 4610; Horn Island, June 1, 1898, no. 4613.

Related to *P. albomarginatum*, but distinguished by its thinner blades and more slender culms, which are leafy nearly to the panicle.

Delphinium Carolinianum and related Species

By P. A. Rydberg

None of our native larkspurs has been more misunderstood than *Delphinium Carolinanum* Walt., or *D. azureum* Michx. This species is found in the southern states only, its northwestern limit being in Missouri. All specimens from the western states referred to it belong to one of the other species described below. Any one who has collected specimens of so-called *D. azureum* in the prairie states or in the Southwest has found trouble in trying to harmonize the specimens collected with the descriptions in our manuals. Some years ago I came to the opinion that the *D. azureum* of Nebraska and neighboring states was quite different from the *D. azureum* of the South. It is only lately, however, that I have had occasion to give closer attention to the matter, in connection with a partial revision of the Ranunculaceae of Dr. Britton's Flora. I have come to the conclusion that *D. azureum*, as treated in Gray's Synoptical Flora, contains about ten species. I regret that I have not seen mature seeds of a few of the western species, as the seeds afford excellent characters for determination.

All the species treated here have a leafy stem and seeds with a loose cellular coat, that becomes transversely rugose squamellate. The most prominent characters by which they may be distinguished from each other are the following:

Bractlets some distance below the calyx and below the thickened portion of the pedicel.
- Sepals deep blue; principal segments of the leaves cuneate, cleft nearly or quite to the middle. 1. *D. geraniifolium.*
- Sepals white, tinged with blue; segments cleft beyond the middle into narrow oblong or linear lobes.
  - Spur about twice as long as the petals; sepals obovate.
    - Spur straight or slightly curved.
      - Lobes of the lateral petals not diverging; lower pedicels not much elongated; spur mostly horizontal. 2. *D. albescens.*
      - Lobes of the lateral petals diverging; lower pedicels elongated; spur mostly erect. 3. *D. camporum.*
    - Spur strongly curved upward. 4. *D. Penardi.*
  - Spur thrice as long as the petals, slightly *s*-curved; sepals oblong. 5. *D. macroseratilis.*

Bractlets close under the calyx on the thickened end of the pedicels.
Sepals greenish or yellowish white; segments of the upper leaves oblong.
6. *D. virescens.*
Sepals blue or bluish; segments of the upper leaves narrowly linear.
Plant tall, slender, green; bractlets narrowly linear, almost subulate.
Seeds strongly wing-margined, only slightly rugose-squamellate; raceme simple and narrow. 7. *D. Carolinianum.*
Seeds not wing-margined, strongly squamellate; raceme often branched.
8. *D. vimineum.*
Plant low, stout, more or less canescent; bractlets linear or lanceolate.
Sepals deep blue; pedicels ascending. 9. *D. Geyeri.*
Sepals light blue or white, tinged with blue or purple; pedicels erect.
10. *D. Wootoni.*

1. **Delphinium geraniifolium** sp. nov.

Stem from a deep woody perennial root, stout, 3–4 dm. high, finely grayish-strigose; leaves numerous, especially at the base, long-petioled, grayish-strigose, mostly 5-divided to the base; divisions cuneate, twice 2–3-cleft into broad oblong divisions; racemes many-flowered, somewhat branched; pedicels ascending; bractlets linear, 2–4 mm. below the blue calyx; spur stout, horizontal, about one half longer than the petals, slightly curved; upper petals brownish, tipped with blue; seeds unknown.

This is evidently nearest related to *D. Geyeri*, but differs by the broad leaf segments and the form and position of the bractlets. Dr. Gray referred it to *D. vimineum*, which it resembles very little.

ARIZONA: Charles Valley, 1883, *H. H. Rusby.*

2. **Delphinium albescens** sp. nov.

Generally tall, 3–15 dm. high, from a woody branched root, finely pubescent or glabrate below, somewhat viscid above; leaves rather variable, from 5 to 15 cm. in diameter, repeatedly divided into linear or the lower often into oblong divisions; raceme long and simple, sometimes 5–6 dm. long; pedicels erect, 1–2 cm. long; bractlets narrowly linear, borne 2–4 (in fruit often 6–8) mm. below the calyx; sepals white with a blue spot and sometimes tinged with blue; spur stout, about twice as long as the petals, straight or slightly curved, tinged with blue, generally horizontal or ascending; upper petals very oblique at the summit, tinged with yellow; the lateral ones bearded, 2-cleft, but the lobes not diverging; follicles cylindric, pubescent; seeds 1.5–2 mm. long, brown, sharply angled but not wing-margined, rather strongly squamellate.

This species has been included in *D. Carolinianum*, but is easily distinguished by the color of the flowers, the form and position of the bractlets, the stouter habit, and especially by the seeds. Its

distinctness from *D. camporum* is not so clear. The principal character used by Prof. Greene in order to distinguish the latter from *D. Carolinianum*, viz., the erect spur, does not hold, for *D. Carolinianum* sometimes has an erect spur; also *D. albescens*, as shown in Dr. Houghton's specimens from Lake Winnipeg. These were included by Greene in *D. camporum*, but are very unlike the plant from Texas, New Mexico and Arizona, which must be taken for the type of *D. camporum*. Houghton's plant differs in no respect, except the erect spur, from the common Larkspur of the Prairie Region. The specimens from Arkansas cited below are more slender and have narrower leaf-segments than is usual. The following specimens of *D. albescens* are found in the herbaria of the New York Botanical Garden and Columbia University.

MANITOBA: Lake Winnipeg, *Dr. Houghton.*

MINNESOTA: Hennepin Co., 1890, *J. H. Sandberg;* Fort Snelling, 1889, *E. A. Mearns.*

SOUTH DAKOTA: Scalp Creek (collector not given).

NEBRASKA: Lincoln, 1887, *H. J. Webber* (type); Crete, 1881, *G. D. Sweezey.*

KANSAS: Ft. Riley, 1892, *E. E. Gayle*, 484; Atchison, 1892, *E. B. Knerr;* Riley Co., 1895, *J. B. Norton, 8;* Topeka, 1891, *B. B. Smyth;* Manhattan, 1889, *W. A. Kellerman.*

COLORADO: Ft. Collins, 1896, *C. F. Baker.*

ARKANSAS: *Dr. Pitcher.*

INDIAN TERRITORY: Sapulpa, 1895, *B. F. Bush, 1091.*

TEXAS: San Antonio, 1894, *A. A. Heller, 1583.*

MISSOURI: Eagle Rock, 1898, *B. F. Bush, 228;* Independence, 1894, 7.

ILLINOIS: Augusta, *S. B. Mead.*

3. DELPHINIUM CAMPORUM Greene, Erythea, **2**: 183

This species is closely related to the preceding, but is generally lower and stouter, with numerous basal leaves and few stem-leaves; the lower pedicels are much elongated, often 5 cm. long; the pedicels as a rule are strongly curved at the end, bringing the spur into an erect position. The flowers are similar to those of the preceding, but generally more purely white, and the lobes of the some-

what longer lateral petals are more divergent. The upper petals are less oblique at the top. To this species, I refer the following specimens:

NEW MEXICO: Jorunda del Murto, 1851, *Geo. Thurber, 291;* Mangus Spring, 1881, *H. H. Rusby, 5;* 1852, *C. Wright, 840.*

TEXAS: Rio Bravo del Norte, 1852, *Schott.*

4. DELPHINIUM PENARDI Huth, Helios, **10**: 27. 1892

I have seen no specimens of this species and from the description one would come to the conclusion that it is simply a form of *D. albescens*, the curved spur notwithstanding. We have seeds, however, received from M. E. Autran of the Boissier Herbarium, and these are very unlike those of *D. albescens.* They are large, black, very irregular, and only slightly squamellate; in fact, they are almost identical with those of *D. Geyeri.* The upper petals are also described and figured as being toothed at the apex, a condition I have never seen in *D. albescens.*

5. **Delphinium macroseratilis** sp. nov.

Stem slender, about 3 dm. high, finely grayish-pubescent; leaves divided to the base into 3–5 segments, these again 2–3-cleft; raceme simple, strict, many-flowered; pedicels erect, about 1 cm. long; bractlets 2–4 mm. below the calyx, linear; sepals white, the lower ones with a bluish spot, oblong, more than twice as long as the upper petals; spur about three times as long as the upper petals, tinged with bluish, slightly s-curved; upper petals very oblique and pointed at the summit; lateral ones much longer, 2-cleft and bearded; fruit and seeds unknown.

This is also closely related to *D. albescens*, differing in floral characters and the fewer segments of the leaves. Further study of the species is needed, especially as seeds are lacking.

TEXAS: Tom Greene Co., 1879, *Frank Tweedy.*

6. DELPHINIUM VIRESCENS Nutt. Gen. **2**: 14. 1818

There is only a fragmentary specimen in the Torrey Herbarium, but this is enough to show that it is quite distinct from *D. Carolinianum.* Not only is the corolla of a different color, but it is much larger and the spur is strongly hooked at the end. The plant is much stouter than *D. Carolinianum*, stouter even than any

of the species given below. As the seeds are not known, the species may not belong to the group with squamellate seeds.

7. DELPHINIUM CAROLINIANUM Walt. Car. 155. 1788

D. azureum Michx. Fl. Bor. Am. 1: 314. 1803.

D. Carolinianum is confined to the South, ranging from North Carolina, or perhaps Virginia, to Missouri and south to Florida, Lousiana and Arkansas. It is characterized by the slender habit, the small deep blue flowers, the long straight narrow raceme, the slender and slightly curved and usually horizontal spur.* The seeds are quite different from those of the related species, being smaller, only 1.5 mm. long, with broad wing-margins on the angles and only slightly squamellate on the sides. The following specimens are in the herbaria of the New York Botanical Garden and Columbia University.

GEORGIA: Augusta, 1888, *G. McCarthy*; Flint River at Albany, 1895, *John K. Small.*

FLORIDA: Jackson Co. (collector not given); *A. W. Chapman* (locality not given); West Florida, *Chapman.*

ALABAMA: *Buckley* (locality not given); Milstead, 1896, *L. M. Underwood;* Auburn, 1897, *Earle & Baker.*

MISSISSIPPI: Agency, 1897, *S. M. Tracy.*

MISSOURI: Swan, 1898, *B. F. Bush, 188.*

ARKANSAS: *Nuttall.*

8. DELPHINIUM VIMINEUM Don; Sweet, Brit. Fl. Gard. ser. 2, *pl. 374*

The flowers are similar to the preceding, but the plant is taller, often over a meter high, with slender lax branches. The most striking difference, however, is found in the seeds. These are scarcely angled at all, but with exceedingly strong transverse lamellae and over 2 mm. long. It is a species confined to the Gulf Region.

TEXAS: *Drummond.*

LOUISIANA: Alexandria, and Red River, *Hale.*

* The specimens from Missouri cited here have almost erect spurs.

9. DELPHINIUM GEYERI Greene, Erythea, **2**: 189

This species is characterized by the strigose-canescent pubescence, the ascending instead of erect pedicels, the large blue flowers, the rather large bractlets, which often are half as long as the sepals and borne close under them. The species would not be placed in this group if it did not have squamellate seeds. These are, however, only finely so, rather large, about 3 mm. long, black, irregularly angled, but not wing-margined. The following specimens are in our herbaria:

WYOMING: Cheyenne, 1872, *E. L. Greene;* Laramie River, 1894, *Aven Nelson, 400.*

COLORADO: Fort Collins, 1896, *C. F. Baker.*

10. **Delphinium Wootoni** sp. nov.

Perennial from a deep woody root, 1.5–2 dm. high, finely grayish-strigose; basal leaves rather numerous, grayish-strigulose, rather firm, 3–5-cleft to the base, the divisions cuneate in outline, cleft beyond the middle into oblong or linear acute leaves; stem-leaves similar, very few; raceme short, rather few-flowered; pedicels erect, 1–2 cm. long; bractlets linear, close under the calyx, the latter light blue or white and tinged with blue or purple: petals white, the upper ones tinged with yellow; seeds unknown.

This is closely related to *D. albescens*, but the position of the bractlets, the grayish pubescence, the low stout habit and the firm leaves with broad segments indicate some relationship with *D. Geyeri.* In this, as in several other species, mature seeds are a desideratum.

NEW MEXICO: Organ Mountains, 1893, *E. O. Wooton* (type).

ARIZONA: Ft. Huachuca, *T. E. Wilcox.*

New and interesting Plants from western North America.—VII

By A. A. Heller

Veratrum caudatum

Stems tall, 2–2.5 meters high, leafy, clothed with short woolly hairs: leaves glabrous, except the margins, which are slightly ciliate, those on the lower third of the stem elliptical or elliptical-lanceolate, 3–4 dm. long, 1.5–2 dm. wide; those on the middle and upper portion of the stem lanceolate, gradually decreasing in size: inflorescence 4 dm. or more in length, branched below, the main rachis prolonged into a tail-like extension 2 dm. or more in length: floral bracts lanceolate, acuminate, about half the length of the perianth: perianth short-pedicelled, 1.5 cm. long, white, the green base pubescent, the divisions lanceolate or linear-lanceolate, only 2–3 mm. wide, slightly toothed, especially near the slender apex.

Our no. 4013, collected in wet meadows at Montesano, Chehalis county, Washington, July 6, 1898, at an elevation of about 50 feet. The type specimen is in my private herbarium.

This species is remarkable for the caudate upper portion of the inflorescence, no other species known to me approaching it in this respect. The divisions of the perianth are also unusually narrow. The plants are gregarious in habit, a dozen or two of them usually growing in proximity.

Verbena MacDougalii

Perennial, gray pubescent throughout: stems stout, simple, obtusely four-angled, the angles light colored, leafy throughout, 4 dm. high: leaves oblong-lanceolate, on short stout petioles, thickish, prominently veined, velvety to the touch, the margins scabrous, irregularly incised-serrate, 7–9 cm. long: spikes solitary or sometimes several, on pedicels 3 cm. long, dense while in flower, rather stout, the flowering portion 6 cm. long, but probably elongating in fruit: fruits scattered on the older lower portion of the spike: bracts slender, lanceolate, acuminately prolonged, 5 mm. long, one third longer than the calyx: flowers small, lilac-purple.

Dr. D. T. MacDougal's no. 249, collected July 8, 1898, "in moist soil in valley near Flagstaff, Arizona." The type specimen

is deposited in the herbarium of the New York Botanical Garden.

The southwestern representative of *V. stricta*. It is less pubescent than that species, has a narrower leaf, the flowering spike is less compact in age, the flower is smaller and lighter colored, and the bracts are much longer. It also occurs near Santa Fé, New Mexico, growing in meadows along Santa Fé creek.

STACHYS PUBENS (A. Gray) Heller, Bull. Torr. Bot. Club, **25**: 582. 1898

Stachys ciliata var. *pubens* A. Gray Syn. Fl. N. A. **2**[1]: 388. 1878.

Stachys palustris Linn. var. Torr., U. S. Explor. Exped. 17: 408.

This is a species quite distinct from *S. ciliata*, and apparently not well understood. The type was collected by Dr. Holmes on the Fraser river. Like most specimens from the older collectors, it is imperfect, showing only the upper half or third of what was evidently a tall, stout plant. The prominent angles are covered with retrorse, prickle-like hairs, the leaves are thick, densely pubescent with soft-pilose hairs, and have short stout petioles. The calyx is very hirsute, its lobes ending in a long spine-like tip. The flowers are more slender, and a trifle smaller than those of *S. ciliata*.

In the herbarium of Columbia University is a second sheet, also referred by Torrey to "*Stachys palustris* Linn. var." The label bears the legend "Gray's Harbor & S. to California." On the sheet are two plants, one of which is undoubtedly *S. ciliata*, and I take it to be the plant collected at "Gray's Harbor," for *S. ciliata* is abundant thereabouts. The other one probably goes with the "& S. to California." It is close to *S. pubens*, and may be the plant Gray had in mind when he mentioned *S. Rideri* in connection with his *S. ciliata* var. *pubens*.

STACHYS CILIATA Dougl.; Benth. Lab. Gen. et Sp. 539. 1834

Our no. 3960, collected at Montesano, Chehalis county, Washington, June 27, 1898, should be referred to this species, and not to *S. pubens*, under which name it was distributed. These specimens seem to be pretty typical, although a little more pubescent than typical material in the herbarium of Columbia University. This

Columbia specimen was presumably collected by Douglas, as it was received from Hooker, and is labelled "*Stachys ciliata*—Fl. Bor. Am." The Scouler specimen, no. 196, represented in the Columbia herbarium, is unlike any other specimen that I have seen, but it was taken from a deformed plant, which may account for the smaller and smoother calyx. Scouler's specimens are also cited as part of the type.

STACHYS EMERSONI Piper, Erythea, 6: 31. 1898

Our 3902, collected at Montesano, Chehalis county, Washington, during June, 1898, and distributed as *S. ciliata*, is the recently described *S. Emersoni*. When the determination was made I had not seen any specimens of Piper's species, and was misled by the imperfect specimen of Scouler, mentioned above. *S. Emersoni* is apparently common in that part of Washington adjacent to Gray's Harbor, growing equally well in rich, shaded ground along streams, and in higher and drier places. A favorite place of growth about Montesano, was along fences and even in gardens and yards.

Stachys Cooleyae

Height of plant unknown, but probably several decimeters: stem sparingly retrorsely barbed below the inflorescence, the part occupied by the inflorescence puberulent or glandular-hairy: leaves distant, ovate-lanceolate, or the uppermost lanceolate, thin, light green, crenate-serrate, shortly acuminate, clothed on both sides with short appressed hairs which are not especially noticeable to the naked eye, those below the inflorescence 12–15 cm. long, 4–6 cm. wide, with rounded or cordate base, and slender, scarcely margined petioles 1–2 cm. long; floral leaves lanceolate, merely serrate, sessile, much reduced, but never shorter than the calyx: verticils remote, showing but slight tendency to approximation at the summit, normally six-flowered: calyx purplish, about 1 cm. long, moderately pubescent with spreading white hairs, the spreading lobes slightly over 2 mm. in length, lanceolate, tipped with a slender cusp: corolla pubescent, rose-purple, 2.5 cm. long, its tube twice the length of the calyx, lower lip broad and rounded, not longer than the upper one.

The type, preserved in the herbarium of Columbia University, was collected by Grace E. Cooley, at Nanimo, Vancouver Island, British Columbia, July 18, 1891. It was distributed as *Stachys ciliata* var. *pubens*, but differs from *S. pubens* by being less pubes-

cent, has much thinner, larger leaves, on longer and more slender petioles; the inflorescence is less compact, the calyx is broader with broader and shorter spreading lobes, and the flower has a much broader tube and equal lips. It is closer to *S. ciliata*, but is distinguished by the thin, light green foliage, spreading calyx, and shorter, equally lobed corolla.

Pentstemon Arizonicus

Slender, erect, 1.5–2 dm. high, with several usually prostrate, short branches at base, these leaf-bearing only: leaves opposite, coriaceous, glabrous, dull green, those of the short prostrate branches oval, obtuse, finely crenate or merely undulate, 1–3 cm. long, 5 mm. to 1 cm. wide, tapering into a winged petiole; leaves of the erect stem in about five pairs, the lowest oblanceolate, petioled, finely crenate, about 2 cm. long, 5–7 mm. wide; those on the middle portion of the stem ovate-lanceolate, sessile at the broad base, thence gradually narrowing to the acute apex, a little over 3 cm. long, nearly 1 cm. wide at the base, entire, as are the upper shorter ones, which are lanceolate, acuminate: inflorescence appearing as if secund, lax, scattered over the upper half of the stem: peduncles and pedicels very slender, the former 1 cm. or more in length, nearly smooth, the latter about 5 mm. long, pubescent with slightly kinky hairs: calyx almost 1 cm. long, as long as the corolla-tube, pubescent and somewhat glandular, the lobes lanceolate, long-acuminate, slightly scarious near the base, ciliate: corolla apparently purplish, nearly 3 cm. long, minutely puberulent, abruptly dilated above the calyx: sterile filament glabrous, not enlarged above; anther sacs divergent.

Collected by Dr. D. T. MacDougal in shaded places on the inner slopes of the crater of San Francisco Mountain, near Flagstaff, Arizona, August 8, 1898. The type specimen is deposited in the herbarium of the New York Botanical Garden.

Erigeron MacDougalii

Appressed pubescent, perennial by decumbent rooting stems or stolons: stems slender, weak, curved, seldom or never branching; leaves entire, the basal ones spatulate, obtuse, 2 cm. long, more than half of which length is petiole; stem leaves scattered, linear or the lower ones linear-spatulate, acute or acutish, about 5 mm. long, 1 mm. wide: peduncles scapose, or very rarely borne on a branch, pubescent above, 5 cm. long; heads 1.5 cm. broad, 5 mm. high; involucre hemispheric, its bracts narrow, pubescent, somewhat scarious-margined, tipped with a brown point: rays numerous, purplish: pappus double.

Dr. D. T. MacDougal's no. 390, collected on "dry inner slopes of crater of San Francisco mountain," near Flagstaff, Arizona. The type specimen is deposited in the herbarium of the New York Botanical Garden.

A species related to *E. flagellaris*, but differing in its weaker, more prostrate, simple, downcurved stems, scape-like peduncles, minute leaves, and more pubescent involucre. It is very unlike typical *E. flagellaris* in habit.

Senecio MacDougalii

Perennial, stems rather slender, 4 dm. high, corymbosely branched from near the base, glabrous, leafy throughout: leaves 2-pinnatifid, 2–4 cm. long, the lower slightly petioled, the others sessile, the segments oblong, acute, 1 cm. long, 1–2 mm. wide, the lower ones lobed, the upper ones usually entire; rachis broad for the size of the leaf: heads numerous in corymbs, slender-peduncled, about 3 mm. broad and 7 mm. high: involucre 5 mm. high, the lobes linear-lanceolate, strongly costate, somewhat spreading, tipped with a brown ciliate point; rasys bright yellow, about 2 mm. broad: achenes glabrous: pappu white.

Dr. D. T. MacDougal's no. 342, collected near Flagstaff, Arizona, July 25, 1898. The type specimen is deposited in the herbarium of the New York Botanical Garden.

This species is related to *S. eremophilus*, but is smaller in every way. One difference which strikes the eye at once is the smaller, narrower heads. The leaves are also shorter. It was found "growing in clumps in remains of decayed pine trunks." Professor E. O. Wooton has collected specimens of this species in southeastern New Mexico.

THE GENUS PETALOSTEMON

In April, 1896, the writer published a paper in the BULLETIN entitled "Notes on *Kuhnistera*." In its inception, the idea was to keep separate under the generic name *Kuhnistera*, the Atlantic seaboard and Gulf coast plant long known as *Petalostemon corymbosus*, it being the type of *Kuhnistera*. Finally, though somewhat unwillingly, he was led to adopt the single genus theory, and included all of the species under *Kuhnistera*. Although there are several species of *Petalostemon* which have rather long calyx-lobes or broad floral bracts, they are so utterly unlike the peculiar plant

of the southeastern part of the United States, which at first sight is often mistaken for a composite, that the two genera should not be united. Having described several species as *Kuhnistera* I now desire to transfer them to *Petalostemon*, where they properly belong.

Petalostemon Gattingeri

Kuhnistera Gattingeri Heller, Bull. Torr. Bot. Club, **23**; 121. 1896.

Petalostemon pulcherrimum

Kuhnistera pulcherrima Heller, Cont. Herb. F. & M. Coll. **1**: 50, *pl. 2.* 1895.

Petalostemon tenue (Coult.)

Petalostemon violaceus var. *tenuis* Coult. Cont. U. S. Nat. Herb. **1**: 34. 1890.

Kuhnistera tenuis Heller, Bull. Torr. Bot. Club, **23**: 124. 1896.

Petalostemon microphyllum (T. & G.)

Petalostemon phleoides var. *microphyllum* T. & G. Fl. N. A. **1**: 310. 1838.

Kuhnistera microphylla Heller, Bull. Torr. Bot. Club, **23**: 122. 1896.

BEDFORD PARK, NEW YORK CITY.

A new Genus of Powdery Mildews—Erysiphopsis

By Byron D. Halsted.

While at a meeting of the A. A. A. S., held in Madison, Wis., in August, 1893, and upon one of the delightful botanical excursions of the week the writer, in company with Prof. S. M. Tracy, found a mildew upon a *Parnassia* in considerable abundance. It has characteristics that do not admit it to any of the existing genera and as it approaches the *Erysiphe* more than any other, the next nearest being *Phyllactinia* the name of *Erysiphopsis*, that is, *like* or *similar* to *Erysiphe* is offered.

Erysiphopsis gen. nov.

Appendages rigid, brittle, usually nearly straight and frequently slightly swollen at the tip.

Erysiphopsis Parnassiae

Amphigenous, but most abundant upon the upper surface; hyphae inconspicuous. Perithecia widely scattered, almost black, 60–110 μ in diameter with reticulations coarse and distinct: appendages 8–15, about 10 μ in diameter at base and varying greatly in length—the shorter, 25–50 μ, being straight and brown throughout with the tips rounded and often distinctly swollen—while the longer are 2–5-septate, somewhat bent, the upper cell being pale brown and without distinctly swollen tips: asci 4–5, oval, pedicillate, 25–30 by 40–45 μ; sporidia oval, usually 4 (4–5), 6–8 by 12–16 μ.

On leaves of *Parnassia Caroliniana* Michx., Madison, Wis.

The key of the genera given below modified from that arranged by Dr. Burrill in his "Erysipheae"* will help to show the position taken by the new genus.

I. Appendages consisting of simple threads similar to the mycelium and often interwoven with it.
  1. Perithecia containing only one ascus. *Sphaerotheca.*
  2. Perithecia containing several asci. *Erysiphe.*
II. Appendages dissimilar to and free from the mycelium.
  A. Appendages simple—not usually forked at the tip.
    3. Appendages coiled at the tip. *Uncinula.*

* Parasitic Fungi of Illinois, Bull. Nat. Hist., 1887.

4. Appendages needle-shaped, abruptly swollen at base. *Phyllactinia.*
5. Appendages not coiled or needle-shaped. *Erysiphopsis.*

B. Appendages dichotomously forked at the tip.

6. Perithecia containing only one ascus. *Podosphaera.*
7. Perithecia containing several asci. *Microsphaera.*

It is not in the same group with *Erysiphe* and is closely associated with *Uncinula* and *Phyllactinia.*

The Saxifragraceae, to which the *Parnassia* belongs, do not abound in mildews and in the United States, they furnish a host for only one species of *Erysiphe* and two for a *Phyllactinia.* Thus *Heuchera Americana* L., is a host for *Erysiphe communis* (Wallr.) and *Heuchera parvifolia* Nutt., and *Philadelphus Lewisii* Pursh, are recorded as bearing *Phyllactinia suffulta* (Reb.). From the standpoint of hosts it is therefore seen that the new species is associated with the *Erysiphe* and *Phyllactinia.*

I am under many obligations to Professor Burrill for his kindness in examining the *Parnassia* mildew, and the suggestions that he has made upon its peculiarities and affinities.

The same fungus has been collected by several others. Dr. Harper, of Madison, Wis., in his reply to my query concerning the identity of the host, stated that he found the mildew at Waukegan, Ill., during the same year it was taken at Madison. Mr. F. L. Stevens, a former student of mine and now of the University of Chicago, found the same in considerable quantity near Syracuse, N. Y., and elsewhere. The species is probably not rare; but one not easily seen, because of the evanescent mycelium and the peculiar glabrous *Parnassia* leaves, as well as the inobtrusive habit of the host.

The Habitats of the Pellaeas

By E. J. Hill

While botanizing the present season along the Desplaines river and some of its tributaries between Lemont and Joliet, Ill., the habits of the cliff-brakes became a subject of special interest. *Pellaea atropurpurea* occurs quite abundantly on ledges of limestone bordering the flood plain of the river as well as on those by some of the smaller streams which have eroded their beds deep into the strata as they approach the gorge of the river. Numerous quarries are worked all along the river. The layers of rock are quite horizontal, and above the level of the flood-plain run back into the low hills and are heavily covered with drift. This has been removed in places to some distance back for the purpose of uncovering the stone, but as the ground rises the superincumbent earth becomes too deep to be taken off with profit, and the quarry is abandoned. Cliff-like, vertical walls are thereby left similar to those which have been made by natural agencies. The wall face thus exposed may have even a greater vertical height than those naturally formed. Some have evidently been left untouched by the quarrymen for many years. But no *Pellaea* was seen on any of these artificially made exposures, though various mosses and other forms of vegetation were well established. The fern, wherever found, grew upon rocks weathered to a dark gray, and with an exposure doubtless of many centuries' duration, or dating back to the time when a glacier carved out the rock bed of the river, its face only changing by the slow process of disintegration. In one locality the evidence was particularly strong. An island of rock had been left in the midst of the valley by the passage of the glacier around on either side, and on the old gray rock at the top of the ridge the fern was growing in plenty, but had not wandered down to a subsequently exposed rock-face made by quarrying below. This is not because the rock recently uncovered does not furnish cavities or shelves on which plants can readily grow, for the layers are relatively thin usually, from the thickness of flagstones to dimension stone two or three feet in depth, and crevices occur plentifully

along the planes of joining. Besides the cliff-brake requires only a slight depression on which to grow. Tiny bunches of young plants, and fronds fruiting when less than an inch high, may be detected on the rocks. The plants wedge their roots into crevices so narrow that it is often difficult to get the bunch out intact. It is not easy to account for this preference of the fern for the old weathered surface. There is noticeable, however, a marked difference in the color of the recently exposed stone and that long subjected to weathering. Some chemical change is produced by atmospheric agencies, for the freshly exposed surfaces are soon stained with yellow or drab due to the presence of iron-oxide. This color is not seen on surfaces long exposed. The absence of the *Pellaea* may not be due to the presence of certain metallic ingredients in excess, but they suggest a possible or partial cause of it. I am able to state in addition that similar conditions have also existed in other localities where I have collected this fern, as witnessed by data on the herbarium labels. These were limestone cliffs in Kankakee county, Ill., they being formed in the same Niagara limestone as that along the Desplaines, the lower magnesian limestones along Root River, Preston, Minn., and the sandstone cliffs by Lake Mendota, Madison, Wis. I have seen the fern in other places, but no memoranda of its habitat being made at the time, I cannot speak with accuracy, but am impressed with the recollection that the exposures were very old. Most authorities that mention the kind of rock on which the cliff-break grows give limestone, but sandstone or other habitats are also mentioned.

Another feature in the behavoir of *Pellaea atropurpurea* is its aversion to shade. In the localities along the Desplaines it is mostly found in quite bright sunlight and on rock faces exposed in such a way as to be not only dry but very warm. Wherever the ledges were shaded but a little by trees the *Pellaea* ceased to grow. Some streams entering the river were examined. One had cut a deep gorge in the limestone below Lockport, and there were numerous exposures of the gray-weathered stone. But the fern was only seen in one place where a sharp bend in the stream, with the comparative absence of trees to shade it, gave the cliff a full exposure to the south. Another stream had made its way down

to the river valley and formed a little waterfall where it emerged from the layers of rock. The projecting faces which flanked the basin below the fall were fully exposed to the sunlight and were well stocked with the plant. Above the fall was a little rocky glen, in dark shade, moist and covered with various kinds of moss and other shade-loving plants. Here the smaller cliff-brake, *Pellaea Stelleri*, found a congenial home, interspersed with *Cystopteris bulbifera*, *Marchantia polymorpha* and another Liverwort, *Asterella hemispherica*. It is a fern of quite different habit, showing its preference for rocks, but needing shade and moisture, as well as moss or decaying vegetable and rock-matter, in which its slender, horizontal rootstocks can run. It is the second locality in which I have met with this cliff-brake in Illinois, the other being a similar ravine or rock-cutting made by a brook entering the Kankakee river below the city of Kankakee. I have no information of its presence elsewhere in the state. Both stations are quite far south for it, and it must be here well-nigh the southern limits of its range.

CHICAGO, ILL.

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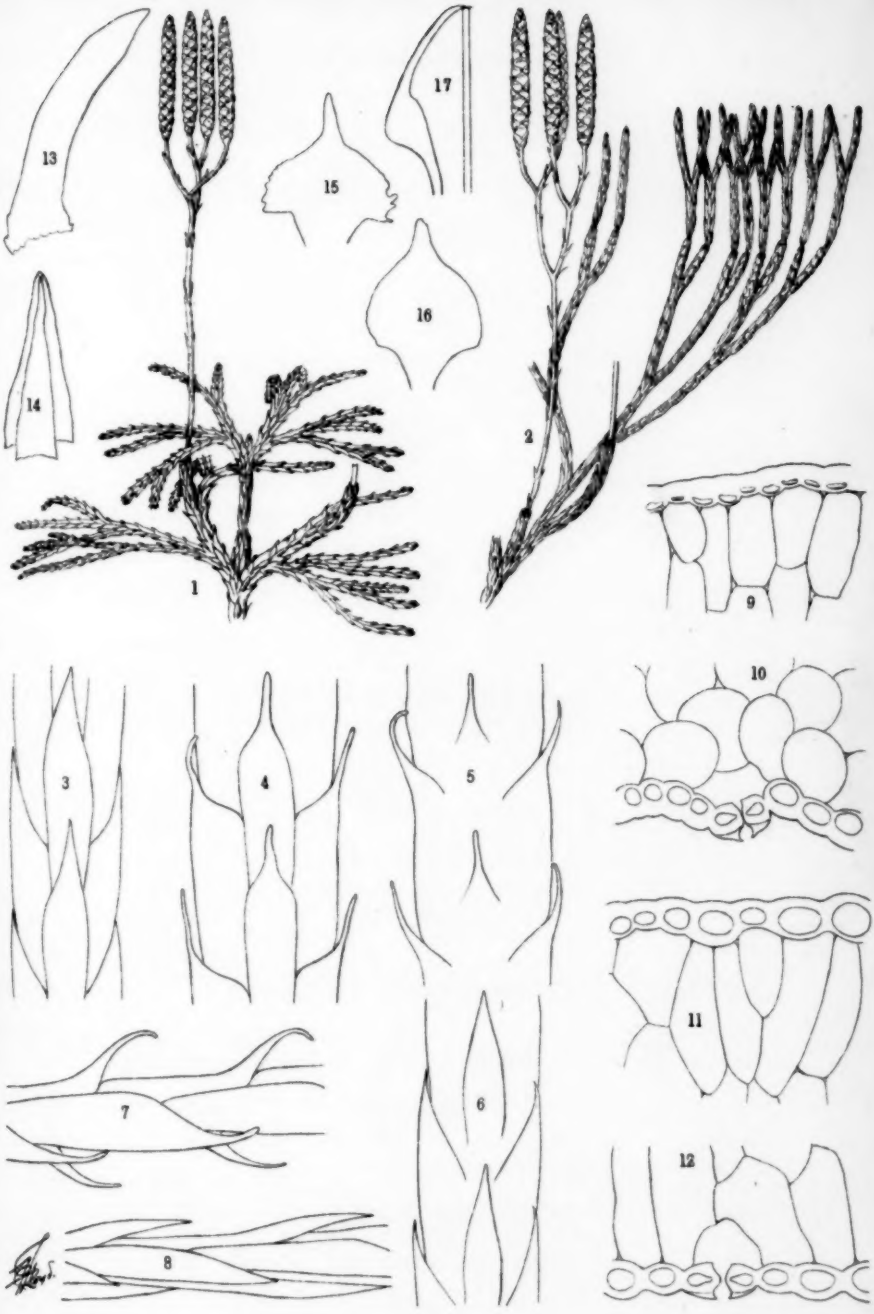

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